

# PATENT COOPERATION TREATY

**RECEIVED**

From the INTERNATIONAL SEARCHING AUTHORITY

**PCT**

APR 16 2009

Downs Rachlin Martin PLLC

To:  
THOMAS D. KOHLER  
DOWNS RACHLIN MARTIN PLLC  
199 MAIN STREET  
P.O. BOX 190  
BURLINGTON, VT 05402-0190

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT AND  
THE WRITTEN OPINION OF THE INTERNATIONAL  
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing (day/month/year)	<b>14 APR 2009</b>
Applicant's or agent's file reference 12833-029WO	<b>FOR FURTHER ACTION</b> See paragraphs 1 and 4 below
International application No. PCT/US 09/35258	International filing date (day/month/year)    26 February 2009 (26.02.2009)
Applicant AB-CWT, LLC	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

**Filing of amendments and statement under Article 19:**

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

**When?** The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

**Where?** Directly to the International Bureau of WIPO, 34 chemin des Colombettes  
1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 8270

**For more detailed instructions,** see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

**4. Reminders**

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer:  Lee W. Young  PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774
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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 12833-029WO	<b>FOR FURTHER ACTION</b> <div style="float: right; font-size: small;">see Form PCT/ISA/220 as well as, where applicable, item 5 below.</div>	
International application No. PCT/US 09/35258	International filing date ( <i>day/month/year</i> ) 26 February 2009 (26.02.2009)	(Earliest) Priority Date ( <i>day/month/year</i> ) 26 February 2008 (26.02.2008)
Applicant AB-CWT, LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed.  
☐ a translation of the international application into \_\_\_\_\_ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☒ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.  
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.  
☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 8  
☒ as suggested by the applicant.  
☐ as selected by this Authority, because the applicant failed to suggest a figure.  
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☐ none of the figures is to be published with the abstract.

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 09/35258

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 4-9, 14-16, 21, 25-36, 40-46 and 53-59  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 09/35258

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C07C 1/00 (2009.01)

USPC - 585/241

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

USPC - 585/241

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
USPC - 201/25; 210/774, 210/806; 422/184.1; 585/241

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST (PGPB, USPT, USOC, EPAB, JPAB); Google

Hydrocarbon, waste, stream, decompose, entrained solid, temperature, pressure, psig, hydrolysis, hydrolyze, agitate, heat exchanger, screen, incline, garbage, liquid, outlet, vessel, solid, bottom, baffle, and off-center

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/0192981 A1 (Appel et al.) 30 September 2004 (30.09.2004), Fig 1-2 and 5, para [0031]-[0032], [0053]-[0056], [0061], [0063], [0065]-[0070], [0072]-[0074], [0076]-[0078], [0081]-[0082], [0087], [0090]-[0093], [0097], [0105], [0110], [0113]-[0117], [0120], [0123], [0138]-[0139], [0159], and [0161]	1-3 and 22-23
Y	US 2007/0098625 A1 (Adams et al.) 03 May 2007 (03.05.2007), para [0087], [0122]	10-13, 17-20, 24, 37-39, and 47-52
Y	US 2006/0231510 A1 (Benachenhou) 19 October 2006 (19.10.2006), para [0043], [0048] and [0054]	10-13 and 24
Y	US 6,387,221 B1 (Schoenhard) 14 May 2002 (14.05.2002), Fig. 1 and col 4 ln 17-27	17-20
Y	US 5,425,925 A (Kline et al.) 20 June 1995 (20.06.1995); Fig 1, 3-4, and 9; col 3 ln 49; col 5 ln 15-17 and 43-44; col 7 ln 8-9, 13, and 18-20; col 8 ln 5, 23, and 37-42; and col 9 ln 2-3, and 7-14	18-19, 37-39
		47-52

☐ Further documents are listed in the continuation of Box C.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

06 April 2009 (06.04.2009)

Date of mailing of the international search report

14 APR 2009

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

# PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: THOMAS D. KOHLER  
DOWNS RACHLIN MARTIN PLLC  
199 MAIN STREET  
P.O. BOX 190  
BURLINGTON, VT 05402-0190

Date of mailing  
(day/month/year) **14 APR 2009**

Applicant's or agent's file reference  
**12833-029WO**

## FOR FURTHER ACTION

See paragraph 2 below

International application No. <b>PCT/US 09/35258</b>	International filing date (day/month/year) <b>26 February 2009 (26.02.2009)</b>	Priority date (day/month/year) <b>26 February 2008 (26.02.2008)</b>
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International Patent Classification (IPC) or both national classification and IPC  
**IPC(8) - C07C 1/00 (2009.01)**  
**USPC - 585/241**

Applicant **AB-CWT, LLC**

**1. This opinion contains indications relating to the following items:**

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

**2. FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

**3. For further details, see notes to Form PCT/ISA/220.**

Name and mailing address of the ISA/US  
Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450, Alexandria, Virginia 22313-1450  
Facsimile No. 571-273-3201

Date of completion of this opinion  
**06 April 2009 (06.04.2009)**

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300  
PCT OSP: 571-272-7774

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 09/35258

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
  - ☒ the international application in the language in which it was filed.
  - ☐ a translation of the international application into \_\_\_\_\_ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
  - a. type of material
    - ☐ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material
    - ☐ on paper
    - ☐ in electronic form
  - c. time of filing/furnishing
    - ☐ contained in the international application as filed
    - ☐ filed together with the international application in electronic form
    - ☐ furnished subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 09/35258

**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of

- ☐ the entire international application
- ☒ claims Nos. 4-9, 14-16, 21, 25-36, 40-46 and 53-59

because:

- ☐ the said international application, or the said claims Nos. \_\_\_\_\_ relate to the following subject matter which does not require an international search (*specify*):

- ☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. see above are so unclear that no meaningful opinion could be formed (*specify*):

Claims 4-9, 14-16, 21, 25-36, 40-46 and 53-59 because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

- ☐ the claims, or said claims Nos. \_\_\_\_\_ are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):

- ☒ no international search report has been established for said claims Nos. 4-9, 14-16, 21, 25-36, 40-46 and 53-59

- ☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

- ☐ furnish a sequence listing on paper complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.
- ☐ furnish a sequence listing in electronic form complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in a form and manner acceptable to it.
- ☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13ter.1(a) or (b).

- ☐ a meaningful opinion could not be formed without the tables related to the sequence listings; the applicant did not, within the prescribed time limit, furnish such tables in electronic form complying with the technical requirements provided for in Annex C-bis of the Administrative Instructions, and such tables were not available to the International Searching Authority in a form and manner acceptable to it.

- ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in electronic form only, do not comply with the technical requirements provided for in Annex C-bis of the Administrative Instructions.

- ☐ See Supplemental Box for further details.

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US 09/35258

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Claims	10-13, 17-20, 24, 37-39, and 47-52	YES
	Claims	1-3 and 22-23	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-3, 10-13, 17-20, 22-24, 37-39, and 47-52	NO
Industrial applicability (IA)	Claims	1-3, 10-13, 17-20, 22-24, 37-39, and 47-52	YES
	Claims	None	NO

**2. Citations and explanations:**

Claims 1-3 and 22-23 lack novelty under PCT Article 33(2) as being anticipated by US 2004/0192981 A1 to Appel et al. (hereinafter "Appel")

As per claim 1, Appel discloses a process comprising preparing a slurry (para [0053], "The preparation stage... results in a slurry") from the waste materials (para [0053], "The raw feed... may potentially be any waste product") to form a process stream (para [0139], "incoming process stream"); accumulating a volume of the process stream in a stirred vessel (para [0068], "the vessel is equipped with ... a multi-blade motorized stirrer that can simultaneously stir the slurry in each of the chambers") after said preparing at a temperature of between about 60-70 .C (para [0067], "the feed storage tank comprises a first tank... heated to a temperature of about 140.degree. F., or about 60.degree. C."); heating the process stream to a temperature between about 125-200 .C (para [0082], teaching "temperatures in the range from about 150.degree. C. to about 330.degree. C") at a pressure between about 20-600 psig (para [0067], "subjects the contents to a pressure of up to about 100 p.s.i.") to decompose solid organic materials and separate organic from inorganic materials (para [0067], "conditions in the second tank are typically harsh enough to breakdown proteinaceous materials in the slurry"); separating solids resulting from said decomposing from the process stream (para [0070], teaching a second stage comprising "separations of the feed that comes out of the first stage reactor," which produces a "mixture of steam and gases, organic liquor, minerals, and water with solubles"); accumulating a volume of the process stream in an agitated vessel after said separating (para [0068], "the vessel is equipped with ... a multi-blade motorized stirrer that can simultaneously stir the slurry in each of the chambers") at a temperature of between about 115-180.C (para [0082], teaching "temperatures in the range from about 150.degree. C. to about 330.degree. C") and a pressure of between about 15-175 psig (para [0067], "and subjects the contents to a pressure of up to about 100 p.s.i."); monitoring at least one parameter of the process stream (para [0065], "operating parameters of the process of the present invention may be adjusted in one or more instances"); heating the process stream to a temperature of between about 200-270 .C (para [0082], teaching "temperatures in the range from about 150.degree.C. to about 330.degree.C") at a pressure between about 210-800 psig (para [0081], teaching slurry processing at pressures of 20-120 atmospheres, or 290 to 1700 psi) to hydrolyze the process stream (para [0078], teaching hydrolysis of the slurry); flashing the process stream to a lower pressure after said hydrolysis to remove steam and non-condensable gases (para [0087], teaching wherein the stream is "flushed to a lower pressure... to vent off remaining steam and gases"); removing entrained solids from the process stream after flashing (para [0090], "The separation stage uses separating equipment... to remove very fine carbon solids from an intermediate feed"); and separating water from the process stream to produce a liquid hydrocarbon fuel (para [0092], "The organic liquor/water mixture is subject to a second separation to drive off the water and leave the organic liquor").

As per claim 2, Appel discloses claim 1 and further discloses wherein said separating water comprises at least two different water separation steps (para [0092], teaching water separation by centrifugation, and para [0093], teaching water separation by evaporation).

As per claim 3, Appel discloses claim 1 and further discloses wherein the process further comprises, after the agitated vessel and before hydrolysis, pressurizing the process stream to a pressure between about 800-1000 psig (para [0081], teaching slurry processing at pressures of 20-120 atmospheres, or 290 to 1700 psi); and raising the temperature of the process stream to a temperature greater than about 220.C (para [0082], teaching "temperatures in the range from about 150.degree. C. to about 330.degree. C") in a heat exchanger after said pressurizing (para [0087], teaching the use of heat exchangers).

-- Please See Supplemental Box --



WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 09/35258

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Box V.2. Citations and explanations:

As per claim 22, Appel discloses a process comprising at least one of plastics and rubber (para [0032], "tires and plastics"), said process comprising combining the waste materials with a liquid input to form a process stream (para [0053], disclosing wherein a raw feed is ground to a suitable size and then combined with water to form a slurry for processing) decomposing the process stream by application of heat and pressure (para [0054], "In a first stage, the slurry is subjected to heat and increased pressure", and para [0067], disclosing wherein conditions in the first stage "are typically harsh enough to breakdown proteinaceous materials in the slurry"); separating solids from the process stream after decomposing to form a substantially liquid process stream (para [0057], "The reacted feed is then subjected to a separation stage in which a further mixture of steam and gases is driven off, and a mixture of minerals or other solid materials is separated out."); fractionally distilling the substantially liquid process stream (Fig. 2. and para [0073], "The organic liquor 500 that is subjected to fractional distillation") to produce at least higher (para [0073], "heavier materials") and lower molecular weight fractions (para [0073], "More volatile materials"); hydrolyzing at least the higher molecular weight fraction of the process stream by application of heat and pressure (para [0138], disclosing wherein the product stream can be "hydrolyzed by means of heat and pressure") to produce a hydrolyzed process stream containing a hydrocarbon liquid and water (para [0139], disclosing wherein the hydrolysis step produces a slurry containing the hydrocarbons and water); and separating entrained particles (para [0090], "remove very fine carbon solids from an intermediate feed") and water from the hydrolyzed process stream to produce the hydrocarbon liquid (para [0092], "drive off the water and leave the organic liquor") suitable for use as a fuel (para [0074], disclosing wherein the organic liquor is processed "to produce oil and fuel-gas").

As per claim 23, Appel teaches claim 22 and further teaches wherein at least a portion of the lower molecular weight fraction is directed to said decomposing step as a solvent (para [0105], teaching wherein the "final stage oil" derived from tire processing "is a superior solvent for tires", and wherein "at least some of the tire-derived hydrocarbons are redirected to the input raw feed to assist with dissolving").

Claims 10-13 and 24 lack an inventive step under PCT Article 33(3) as being obvious over Appel in view of US 2007/0098625 A1 to Adams et al. (hereinafter "Adams")

As per claim 10, Appel teaches a system comprising a grinder to reduce the particle size of the feedstock (para [0053], "reduce the size of the raw feed using pulping and other grinding technologies") and form a slurry therefrom (para [0053], "results in a slurry"); a first storage tank configured to receive the slurry from the grinder (para [0067], "After feed preparation and feed slurring, the slurry is passed to... a feed storage tank"), the storage tank including circulation means (para [0068], "vessel is equipped with baffles, and a multi-blade motorized stirrer") and heating means (para [0110], "heater"); a first reactor vessel (para [0068], "The first stage... is carried out in a first stage reactor") configured to receive the slurry from the storage tank (para [0067], teaching wherein the slurry is passed from the "feed storage tank" to the "first stage reactor"), the first reactor vessel defining a solids outlet, liquid outlet and vapor outlet (para [0070], teaching the separation of the process stream into solids, liquids, and gases, and Fig. 2, showing wherein the solids, liquids, and gases are each directed through separate outlets for further processing) and having stirring means (para [0068], "vessel is equipped with baffles, and a multi-blade motorized stirrer") and heating means (para [0110], "heater"); a second storage tank communicating with the liquid outlet of the first reactor vessel (Fig. 2 and para [0072], "The organic liquor 500... may be contained in an organic liquor holding vessel 252 prior to transfer to the third stage reactor 260") defining a liquid outlet; a high pressure pump receiving liquid from the second storage tank liquid outlet (para [0076], teaching a "high-pressure slurry pump" which can be used to transport the process stream from a storage tank to a processing vessel); a heat exchanger configured to receive pressurized liquid from said pump and to heat said liquid (para [0076], teaching a "heat exchanger" which can be used to transport the process stream from a storage tank to a processing vessel); a second reactor vessel configured to receive the heated and pressurized liquid from the heat exchanger (para [0072], teaching wherein the organic liquor is transferred to the "third stage reactor" from the storage vessel), said second reactor vessel defining a vapor outlet (para [0061], teaching wherein the third stage produces "hydrocarbon vapor and gases", and para [0063], teaching wherein the vapors and gases and transferred out of the vessel for further processing), and including stirring means (para [0068], "vessel is equipped with baffles, and a multi-blade motorized stirrer"); a high pressure flash vessel configured to receive liquid at high pressure from said second reactor vessel and reduce the pressure to a lower pressure (para [0087], teaching wherein a process stream from a reactor vessel is "flushed to a lower pressure"), a steam recovery line communicating between the high pressure flash vessel and the first reactor vessel, forming at least a part of said first reactor vessel heating means (para [0070], "Steam and gases are preferably diverted back to the preparation stage to assist with feed heating"); a low pressure flash vessel configured to receive low pressure liquid from the high pressure flash vessel and reduce the pressure further to approximately ambient pressure (para [0087], "Typically, flashing is achieved through multiple pressure reductions, preferably in two to three stages"); particulate removal apparatus communicating with the low pressure flash vessel (para [0091], teaching wherein the organic liquor produced from the flashing vessel is subjected to a separation which removes solids particles); a first water separator receiving liquid from the particulate removal apparatus (para [0092], teaching water separation by centrifugation); a second water separator receiving liquid from the first water separator (para [0093], teaching water separation by evaporation). Appel fails to teach the further claim limitation taught by Adams, namely wherein the second storage tank also includes a vapor outlet (para [0122], which teaches that "steam and gaseous impurities are preferably vented" while the process stream is being stored). Appel and Adams fail to teach wherein the system includes a metal detector configured to receive raw waste feedstock and remove metal from the feedstock. However, it would have been obvious to one with ordinary skill in the art to include a metal detector and separator in the system because this would remove harmful metal particles which could damage downstream processing equipment or produce impurities in the final fuel product. It would have been obvious to one with ordinary skill in the art to combine the teachings of Appel and Adams in order to provide a more efficient aricultural conversion system.

-- Please See Supplemental Box 2 --

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.  
PCT/US 09/35258

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:  
See Supplemental Box 1

As per claim 11, Appel and Adams teach claim 10 and Appel further teaches wherein said first storage tank heating means comprises at least one heat exchanger disposed to receive slurry from the grinder and deliver heated slurry to the first storage tank (para [0067], teaching wherein the process slurry is heated using a heat exchanger), said at least one heat exchanger communicating with said low pressure flash vessel to receive recovered heat from said vessel (para [0070], "Steam and gases are preferably diverted back to the preparation stage to assist with feed heating").

As per claim 12, Appel and Adams teach claim 10 and Appel further teaches wherein the system further comprises an auger configured to receive solids from the first reactor vessel (para [0161], teaching wherein an auger can be used to transfer solid particles); and a dryer configured to receive solids from said auger and particulate matter from said particulate removal apparatus (para [0138], teaching wherein solid particles are separated out of the process stream and "subjected to a drying stage", and para [0115], teaching wherein the drying stage uses a dryer).

Appel and Adams fail to teach wherein the auger is a dewatering auger and has a fluid line communicating with the second storage tank to transfer liquids removed from the solids thereto. However, it would have been obvious to one with ordinary skill in the art through routine experimentation to use a dewatering auger which can transfer extracted water back into the system because this would reduce the amount of energy and water wasted in the drying process by using the auger to remove and recirculate the water in a preliminary drying process.

As per claim 13, Appel and Adams teach claim 10 and Appel further teaches wherein the high pressure pump is configured to provide a pressure exceeding about 800 psig (para [0081], teaching slurry processing at pressures of 20-120 atmospheres, or 290 to 1700 psi). Appel and Adams fail to teach wherein the high pressure flash vessel is configured to reduce the pressure to about 125-150 psig and the approximately ambient temperature provided by the low pressure flash vessel is between about 0-5 psig. However, it would have been obvious to one with ordinary skill in the art through routine experimentation to optimize the system with the pressures claimed in claim 13 because these pressures would optimize the process stream separation in the flashing step, which increases the purity of the product while also reducing the energy requirements of the system, thereby increasing the marketability of the system.

As per claim 24, Appel teaches claim 22 and further teaches wherein said separating entrained particles comprises a large particle separation (para [0117], teaching the use of techniques designed to separate larger particles from a mixture). Appel fails to teach the further claim limitation taught by Adams, namely wherein the separation step is followed by desalting (para [0087], teaching wherein a filtered product can be passed through various other refining processes, including desalting). It would have been obvious to one with ordinary skill in the art to include the processing steps taught in Adams with the process taught in Appel because both references relate to methods of converting municipal waste into hydrocarbon fuel and oils using heat, pressure, decomposition, hydrolysis, and filtration to separate the useful material from the waste, and the additional steps taught in Adams increase the purity of the final product produced by the process taught in Appel, thereby increasing the marketability of the product.

Claims 17 and 20 lack an inventive step under PCT Article 33(3) as being obvious over Appel in view of US 2006/0231510 A1 (Benachenhou).

As per claim 17, Appel teaches a reactor apparatus, comprising a vessel with a vessel wall forming sides, a top and a bottom (para [0120], "The housing preferably comprises a spinner case bottom and a spinner case top that are joined to one another"); an inlet disposed in the vessel wall for slurried materials (para [0120], "Inlet permits introduction of the fluid that contains the suspended solids"); a solids outlet (para [0113], teaching "a second outlet for carbon solids"); a vapor outlet (para [0113], "a first outlet for hydrocarbons and gases"); heating means for the contents of the vessel (para [0110], "heater"); a screen member (para [0090], teaching wherein screens are used in separation stages"); a baffle (para [0068], "the vessel is equipped with baffles"); and a mixing element rotatable around the bottom (para [0068], "a multi-blade motorized stirrer").

Appel fails to teach the further claim limitation taught by Benachenhou, namely wherein the solids outlet is in the bottom of the housing (para [0054], teaching wherein a hydrocarbon filtration and separation vessel contains an outlet for solids which settle to the bottom of the vessel); wherein the vapor outlet is adjacent the top (para [0043], teaching wherein outlet ports, such as vapor outlet ports, are positioned near the top of the filtration and separation vessel); and wherein the apparatus includes a reacted liquid outlet disposed in the vessel wall (para [0048], teaching wherein the filtration and separation vessel includes a liquid outlet for a reacted liquid mixture).

Appel and Benachenhou fail to expressly teach wherein the screen member is disposed across the vessel interior; wherein the liquid outlet is above the screen member; and wherein the baffle is off-center and extends downwardly from the screen member and disposed between the vessel center and the inlet, the baffle terminating above the bottom. However, it would have been obvious to one with ordinary skill in the art through routine experimentation to optimize the apparatus by adjusting the screen, the liquid outlet, and the baffle components as disclosed in claim 17 because doing so increases the processing efficiency and accuracy of the apparatus, thereby increasing the purity of the final product and increasing the marketability of the apparatus.

It would have been obvious to one with ordinary skill in the art to include the components taught in Benachenhou within the apparatus taught in Appel because both references relate to methods of filtering and processing hydrocarbon slurries to produce purified hydrocarbon fuels, and the components of Benachenhou increase the processing efficiency and accuracy of the apparatus taught in Appel, thereby increasing the purity of the final product and increasing the marketability of the apparatus.

-- Please See Supplemental Box 3 --

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**Supplemental Box**

**In case the space in any of the preceding boxes is not sufficient.**

Continuation of:  
See Supplemental Box 2

As per claim 20, Appel and Benachenhou teach claim 17 and Appel further teaches wherein the solids outlet comprises an airlock valve (para [0114], teaching the use of "an air lock device" in removing carbon solids from a filtration apparatus). Appel and Benachenhou fail to expressly teach wherein the solids outlet is centrally disposed in the bottom of the vessel. However, it would have been obvious to one with ordinary skill in the art through routine experimentation to place the solids outlet near the center of the bottom of the vessel because this allows for a slight conical or parabolic tapering which directs the settling solids into the solids outlet, which increases the efficiency and simplicity of extracting solids from the apparatus, thereby increasing the marketability of the product.

Claims 37-39 lack an inventive step under PCT Article 33(3) as being obvious over Appel in view of US 6,387,221 B1 to Schoenhard

As per claim 37, Appel teaches a system comprising a first heated pressure vessel (para [0068], teaching a "first stage reactor", and para [0054], "In a first stage, the slurry is subjected to heat and increased pressure") configured to receive waste materials (para [0053], "The raw feed... may potentially be any waste product"), said first heated pressure vessel having a vapor outlet (Fig. 1, showing wherein steam and gases from the first reaction are separated from the process stream), a liquids outlet and a solids outlet (Fig. 1, showing wherein the reacted feed passed from the first reaction to further processing, and para [0056], teaching wherein the "reacted feed" consists of a "mixture of reacted solid products and a mixture of reacted liquid products"); a first particulate separator communicating with the liquids outlet (Fig. 1 and 2, showing a second stage separator which accepts the reacted feed from the first stage and separates the process stream into separate components, including an organic liquid and solids); a solids wash apparatus communicating with the solids outlet to receive solids from said first heated pressure vessel (para [0114], teaching a "carbon solids cooler" which "communicates with the reactor through an air lock device, or optionally the fluid-solid separator", and which washes the solid with water "to assist with the cooling process"); a distillation column configured to receive liquids from the particulate separator (Fig. 2, and para [0073], "The organic liquor 500 that is subjected to fractional distillation is typically distilled in a distillation column 254 said distillation column having outlets (para [0097], "redirected to the third stage") for at least a heavy fraction (para [0073], "heavier materials... are passed on to the third stage reactor") and a light fraction (para [0073], "More volatile materials from the organic liquor... are collected"); a solvent supply line communicating between said light fraction outlet and said first heated pressure vessel (para [0105], teaching wherein the "final stage oil" derived from tire processing "is a superior solvent for tires", and wherein "at least some of the tire-derived hydrocarbons are redirected to the input raw feed to assist with dissolving"); a second heated pressure vessel configured to receive said heavy fraction from the distillation column heavy fraction outlet (Fig. 5 and para [0097], "Fractionated liquor 145 may be redirected to the third stage 140 for processing"); and a second particulate separator (para [0123], teaching a "second cooler" which filters and redirects carbon particulates from the process stream) and a liquid-liquid separator configured to sequentially receive liquids from the second heated pressure vessel liquids outlet (Fig. 8A and para [0159], teaching wherein an organic liquor 500 is passed from the third stage into "a liquid/liquid separator 814") and having an outlet for liquid fuel (para [0159], "The first portion of fractionated liquor/oil may be directed to finished product storage"). Appel fails to teach the further claim limitation taught by Schoenhard, namely wherein the solid and liquid outlets from the first vessel are separate and wherein the second heated vessel includes a liquids outlet in addition to a solid outlet (Fig. 1 and col 4 In 17-21, teaching wherein liquids from a waste processing reaction are withdrawn from the processing chamber through a first fluid outlet; and Fig. 1 and col 4 In 25-27, teaching wherein solids from the same waste processing reaction are withdrawn from the system using a second separate solid outlet). Appel and Schoenhard fail to teach wherein the solids wash apparatus has liquids outlet communicating with said particulate separator and a washed solids outlet. However, it would have been obvious to one with ordinary skill in the art through routine experimentation to include a liquids outlet which routes wash fluid from the solids wash apparatus back into a particulate separator because this allows any materials washed from the solid to be reprocessed through the system, which reduces any waste caused by the washing cycle and increases the amount of product which can be produced, thereby increasing the marketability of the product. It would have been obvious to one with ordinary skill in the art to include the components taught in Schoenhard within the system taught in Appel because both Appel and Schoenhard relate to methods of converting municipal waste into hydrocarbon fuel and oils using heat, pressure, decomposition, and filtration to separate the useful material from the waste, and the additional steps taught in Schoenhard increase the purity of the final product produced by the process taught in Appel, thereby increasing the marketability of the product.

As per claim 38, Appel and Schoenhard teach claim 37 and Appel further teaches wherein the waste comprises a municipal solid waste (para [0032], "municipal sewage sludge, as well as tires and plastics"). Schoenhard also teaches wherein said waste has particle sizes in the range of about 1/2 to about 6 inches (col 3 In 7-8, teaching wherein waste particles are ground "to less than about 3/4-inch dimensions").

As per claim 39, Appel and Schoenhard teach claim 37 and Appel further teaches wherein the distillation column is configured with outlets (para [0097], "redirected to the third stage") for at least a heavy fraction (para [0073], "heavier materials... are passed on to the third stage reactor") and a light fraction (para [0073], "More volatile materials from the organic liquor... are collected"). Appel and Schoenhard fail to teach wherein the distillation column also includes an outlet for medium fractions which communicates with the second heated pressure vessel through a valve. However, it would have been obvious to one with ordinary skill in the art through routine experimentation to include an outlet for circulating medium fractions back into a reaction vessel because this allows the medium fractions to be reprocessed and refined into heavy and light fractions, which can then be further processed into final products, thereby increasing the purity and the amount of the fuel product which can be produced and increasing the marketability of the product.

-- Please See Supplemental Box 4 --

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Supplemental Box

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Continuation of:  
Supplemental Box 3

Claims 47-52 lack an inventive step under PCT Article 33(3) as being obvious over US 5,425,925 A to Kline et al. (hereinafter "Kline") in view of Appel

As per claim 47, Kline teaches a system, comprising a chamber (Fig 3., showing a chamber above the conveyor system); a conveyor housing disposed at least partly below said chamber (Fig 3, showing an angled screw conveyor housing disposed beneath the chamber, and col 5 ln 43-44, "housing surrounding the auger") and defining an opening communicating with said chamber bottom (Fig 3 and col 8 ln 23, "auger inlet") said conveyor housing having a length (col 8 ln 37, "entire length of auger") and exit opposite said opening (Fig 3 and col 8 ln 39, "solid discharge port"); a biased closed cover over the conveyor housing exit (Fig 3 and col 8 ln 41-42, teaching a "conical flow restriction 90" which covers the "discharge port 86", and Fig 4 and col 9 ln 2-3, teaching wherein the "conical flow restriction 90" includes a "pneumatically biased hinge 93"); a screen section in the conveyor housing disposed between the opening and exit (Fig 9 and col 9 ln 9, teaching an "auger housing screen 96"), the screen section being configured and dimensioned to permit passage of liquids therethrough while preventing passage of at least substantially all solids (Fig 9 and col 9 ln 7-11, "Liquid medium... exits auger 74 through perforations 94 in auger housing screen 96. Perforations 94 are sized small enough to restrict the solid waste from the liquid stream."); a conveyor disposed within the conveyor housing, said conveyor extending from the chamber open bottom to an end point within the housing spaced from the housing exit (Fig 3 and col 8 ln 5, teaching an "auger 74" which extends from the chamber opening and which has auger blades which terminate within the housing); at least one wash nozzle (col 3 ln 49, teaching jets used in a "wetting stage"); a first vessel configured to receive liquids communicating with the conveyor housing screen section (Fig 3 and col 9 ln 11-14, "A sleeve 98 around screen 96 at perforations 94 channels the liquid medium into a recycle line 100 which is in fluid communication with the mixing tank 156 through recycle inlet line 144"); and a second vessel communicating with the conveyor housing exit configured to receive solids carried over the screen section from the conveyor (Fig 3-4 and 8 ln 41-42, teaching a "conical flow restriction 90" which covers the "discharge port 86"). Kline fails to teach the further claim limitation taught by Appel, namely wherein the chamber is a decomposition reaction chamber (para [0067], teaching a reaction chamber which subjects a process slurry to "conditions... typically harsh enough to breakdown proteinaceous materials in the slurry").

Kline and Appel fail to teach wherein the reaction chamber has an open bottom. However, it would have been obvious to one with ordinary skill in the art through routine experimentation to use an open bottom between the reactor chamber and the conveyor system because this would provide a steady and constant feed rate between the chamber and the conveyor system.

Kline and Appel also fail to teach wherein the wash nozzle is disposed within the conveyor housing between the opening and screen section. It would have been obvious to one with ordinary skill in art through routine experimentation to place wash nozzles with the conveyor system before the screen section because this would allow the reacted process stream to be further treated and washed of additional impurities while being agitated and transferred, whereby the treating and washing liquids can be collected and recycled through the screen system.

It would have been obvious to one with ordinary skill in the art to use the components taught in able within the system taught in Kline because both references relate to methods of processing municipal waste materials to form usable products, and the components taught in Appel improve the purity and usability of the final product, thereby increasing the marketability of the system.

As per claim 48, Kline and Appel teach claim 47 and Kline further teaches wherein the system further comprises a liquids outlet (Fig 1 and col 7 ln 20, "line 162") disposed in the first vessel (Fig 3 and col 7 ln 18, "mixing tank 156") and a tank (Fig 1 and col 7 ln 19, "manifold 50") communicating with said liquids outlet (Fig 1 and 3, and col 7 ln 18-20, teaching wherein liquid is "immediately pumped from the mixing tank 156 into the manifold 50" through a liquid line 162); a sump defined by the conveyor housing and communicating with said tank (Fig 3 and col 7 ln 13, "liquid medium collection tank 56"); a liquids supply line communicating between said tank and the at least one wash nozzle (Fig 1 and col 7 ln 8-9, "liquid medium feed lines 46a,b,c,d are connected to jets 42a,b,c,d respectively"); and a pump disposed in said liquids supply line (col 7 ln 19, "pump 160").

Appel also teaches wherein a heat exchanger disposed in said liquids supply line (para [0031], teaching wherein a heat exchanger can be used to transfer and recycle fluids through the processing system).

As per claim 49, Kline and Appel teach claim 48 and Kline further teaches wherein the conveyor housing is an elongate structure extending upwardly at an angle from the receiving section to the first vessel (Fig 3, showing wherein the conveyor housing extends upwardly at an angle from the receiving section) to define a liquids level therein between said chamber open bottom and said screen section, the liquids level extending part way into the reaction chamber (Fig 3, showing wherein the housing defines a liquids level which extends part way into the reaction chamber); and said lowest point defines the sump (Fig 3 and col 7 ln 13, showing wherein the bottom of the tank forms a "liquid medium collection tank 56").

As per claim 50, Kline and Appel teach claim 47 and Kline further teaches wherein the length of the conveyor housing is sufficient to provide a residence time for solids moving through the conveyor (col 5 ln 15-17, "The controlled rate at which the auger screw carries the waste up the incline to the discharge port enables a sufficient residence time"). Appel also teaches wherein the residence time is at least about 30 minutes (para [0072], teaching the use of a treatment residence time of 700 minutes).

-- Please See Supplemental Box 5 --

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Supplemental Box

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Continuation of:  
Supplemental Box 4

As per claim 51, Kline and Appel teach claim 47 and Kline further teaches wherein the reaction chamber and conveyor housing are sealed together around the open bottom (Fig 3, showing wherein the chamber and the conveyor are sealed together as one solid casing); the first vessel is in sealed communication with the screen section of the conveyor housing (Fig 3 and col 9 ln 12-14, "recycle line 100 which is in fluid communication with the mixing tank 156 through recycle inlet line 144"); and the second vessel is sealed around the conveyor exit (Fig 3 and col 9 ln 11, teaching wherein the housing and second vessel are sealed by "a sleeve 98").

As per claim 52, Kline and Appel teach claim 51 and Kline further teaches wherein the biased closed cover is disposed within the second vessel (Fig 4 and col 9 ln 2-3, teaching wherein the "conical flow restriction 90" includes a "pneumatically biased hinge 93").

Claims 18-19 lack an inventive step under PCT Article 33(3) as being obvious over Appel in view of Benachenhou and in further view of Schoenhard

As per claim 18, Appel and Benachenhou teach claim 17 but fail to teach the further claim limitation taught by Schoenhard, namely wherein the screen member is inclined at an angle (col 2 ln 38, teaching the use of an inclined screen in hydrocarbon filtration). It would have been obvious to one with ordinary skill in the art to include the components taught in Schoenhard within the vessel taught in Appel and Benachenhou because both Appel and Schoenhard relate to methods of converting municipal waste into hydrocarbon fuel and oils using heat, pressure, decomposition, and filtration to separate the useful material from the waste, and the additional steps taught in Schoenhard increase the purity of the final product produced by the process taught in Appel, thereby increasing the marketability of the product.

As per claim 19, Appel, Benachenhou, and Schoenhard teach claim 18 but fail to teach wherein the vessel defines a liquids level and the inclined screen member extends from below the liquids level adjacent the reacted liquids outlet to above the liquids level opposite the reacted liquids outlet. However, it would have been obvious to one with ordinary skill in the art through routine experimentation to optimize the screen configuration as claimed in claim 19 because doing so forces any incoming processed fluid through the screen before it can exit through the liquid outlet, which increases the efficiency and accuracy of the filtration through the screen, thereby increasing the purity of the final product and increasing the marketability of the apparatus.

Claims 1-3, 10-13, 17-20, 22-24, 37-39, and 47-52 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used by industry